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4.1 Integrated Building Design

Integrated building design is a process of design in which multiple disciplines and seemingly unrelated aspects of design are integrated in a manner that permits synergistic benefits to be realized. The goal is to achieve high performance and multiple benefits at a lower cost than the total for all the components combined. This process often includes integrating green design strategies into conventional design criteria for building form, function, performance, and cost. A key to successful integrated building design is the participation of people from different specialties of design: general architecture, HVAC, lighting and electrical, interior design, and landscape design. By working together at key points in the design process, these participants can often identify highly attractive solutions to design needs that would otherwise not be found. In an integrated design approach, the mechanical engineer will calculate energy use and cost very early in the design, informing designers of the energy-use implications of building orientation, configuration, fenestration, mechanical systems, and lighting options.

Opportunities

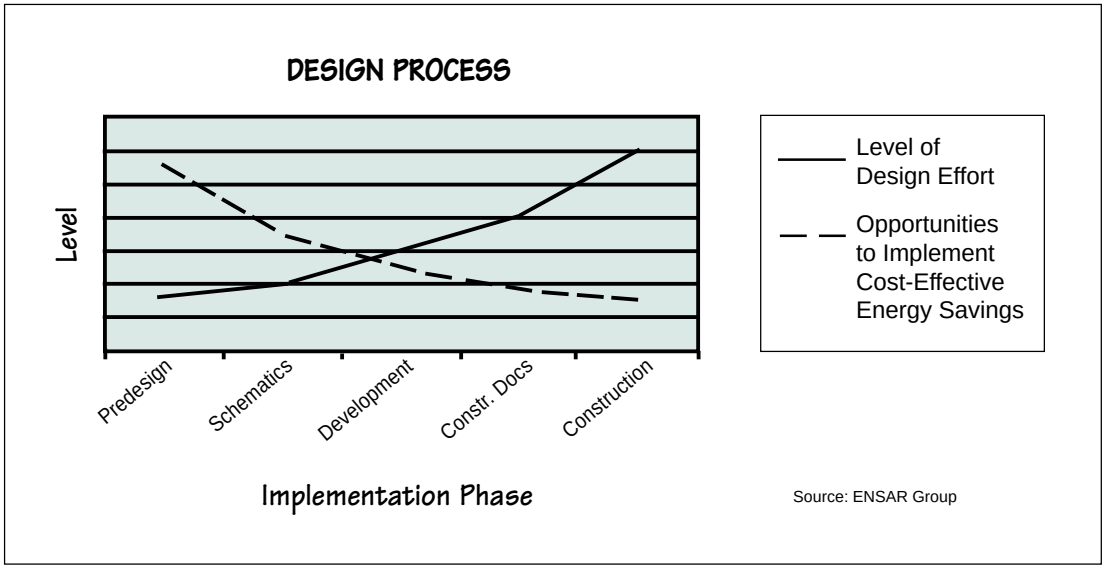
Although integrated building design can be part of almost any Federal facilities project, it is most suitable for the design of new whole buildings or significant renovation projects. Integrated building design is most effective when key issues are addressed early in the facility planning and design process. Opportunities are most easily identified through an open process of exploring how to combine low-energy-use and other greening strategies to achieve the best results.

The graph below suggests that the earlier design integration becomes a part of the process, the more successful the results will be. Conversely, if a building is designed "as usual" and then green technologies are applied to it as an afterthought, the results will probably be poorly integrated into the overall building design objectives, and the greening strategies will likely be expensive to implement.

In existing buildings, opportunities for improved building design integration exist whenever a major replacement or renovation of a building component or system is being planned. For example, if a large chiller system is to be replaced, investments in reducing the cooling loads through daylighting, improved glazing, and more efficient electric lighting may significantly reduce the size and cost of the new chiller. In some cases, cost savings from the new chiller may be greater than investments in the load-reduction strategies, so the ancillary benefits of improved lighting and lower energy consumption are obtained for free—or even at a "negative cost."

Technical Information

Consider integrated building design strategies for all aspects of green design: improving energy efficiency, planning a sustainable site, safeguarding water, creating healthy indoor environments, and using environmentally preferable materials. Major design issues should be considered by all members of the design team—from civil engineers to interior designers—who have common goals that were set in the building program. The procurement of A&E services should stress a



Source: ENSAR Group

The Way Station (above) is an institutional building created for mental health care in Frederick, Maryland. The integrated building design used in creating it included careful siting, climate-responsive building form, energy-efficient envelope design, daylighting, passive solar heating, cooling-load reduction strategies, high-performance glazings, high-efficiency lighting and HVAC equipment, and healthy building design strategies. The net increase in construction cost for this package of measures was $170,000, and the annual energy savings total $38,000—a return-on-investment of 22%.

team-building approach, and provisions for integrated design should be clearly presented in the statement of work (SOW). For example, the SOW should stipulate frequent meetings and a significant level of effort from mechanical engineers to evaluate design options.

The design and analysis process for developing integrated building designs includes:

- **Establishing a base case**—for example, a performance profile showing energy use and costs for a typical facility that complies with Federal energy standards and other measures for the project type, location, size, etc.
- **Identifying a range of solutions**—all those that appear to have potential for the specific project.
- **Evaluating the performance of individual strategies**—one by one through sensitivity analysis or a process of elimination parametrics.
- **Grouping strategies that are high performers** into different combinations to evaluate performance.
- **Selecting strategies, refining the design, and reiterating the analysis** throughout the process.

Finding the right building design recipes through an integrated design process can be challenging. At first, design teams often make incremental changes that are effective and result in high-performance buildings—and often at affordable costs. However, continuing to explore design integration opportunities can sometimes yield incredible results, in which the design team *breaks through* the cost barrier.

Whenever one green design strategy can provide more than one benefit, there is a potential for design integration. For example, windows can be highly cost-effective even when they are designed and placed to provide the multiple benefits of daylight, passive solar heating, summer-heat-gain avoidance, natural ventilation, and an attractive view. A double-loaded central corridor, common in historic buildings, provides daylight and natural ventilation to each room, and transom windows above doors provide lower levels of light and ventilation to corridors. Building envelope and lighting design strategies that significantly reduce HVAC system requirements can have remarkable results. Sometimes the most effective solutions also have the lowest construction costs, especially when they are part of an integrated design.

References

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